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ABSTRACT

An analysis was made of the use of computing tools at the graduate and undergraduate levels in colleges and universities in the United States. Topics ranged from hand-held calculators to the use of main-frame computers and the assessment of the SPSSX, SPSS, LINDO, and MINITAB computer software packages. Hand-held calculators are being increasingly used in college and university classes. As this trend continues, it is forecasted that more institutions of higher education will either have to supply calculators for student use or require all students to buy the same type of calculator. Many computer software packages were used in college and university classrooms: LINDO was found to be good for use in courses involving contemporary mathematics, managerial accounting, and management of operation systems; MINITAB was good for quantitative analysis courses in business administration programs, in basic statistics courses, and in other statistics related courses; and SPSS and SPSSX, two very similar statistical software packages, were good for courses in basic statistics, advanced statistics, business administration analysis, education research, social science research, and psychological research. The implementation of these software programs was considered helpful in equipping students to face the challenges of the twenty-first century. Contains eight references. (GLR)

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TECHNOLOGY IN THE COLLEGE CLASSROOM

by

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TECHNOLOGY IN THE COLLEGE CLASSROOM

ABSTRACT

This paper presents a discussion of some of the computing tools used at the graduate and undergraduate levels in colleges and universities in the United States. Topics range from the use of hand-held calculators to the use of mainframe computer systems. The software systems discussed are SPSSX, SPSS, LINDO, and MINITAB.

CALCULATORS IN COLLEGE AND UNIVERSITY CLASSROOMS

First, let´s talk about hand-held calculators. Hand-held calculators are being used in many college and university classrooms today. One reason for this is their portability. It is much easier to carry a hand-held calculator around from class to class than it is to carry a microcomputer. So that is one of the key advantages of the hand-held calculator over the computer, viz., its portability.

Many people look upon the calculator as a computer. In the broad sense of the word "computer," it is. Usually, at the present time, the term "computer" is reserved for microcomputers, minicomputers, mainframe computers, and the, relatively

new, super computers.

Hand-held caculators are frequently in mathematics classes in colleges and universities. They are used in statistics classes, classes in precalculus, classes in contemporary mathematics, and various other classes in mathematics. Hand-held calculators are also used in real estate classes in colleges and universities. They are used in many graduate and undergraduate level business administration classes, e.g., managerial accounting, financial accounting, and management of operations systems. On the graduate level, hand held calculators are used in courses in educational statistics, educational test and measurements, and many other quantitative courses.

Most of the courses in which calculators are used are courses in which knowledge and theories of mathematics are applied to various fields of study. In many of these courses the professors are not really interested in a lot of theory, but in applications. The use of the hand-held calculator facilitates the professors' desire to emphasize applications instead of theory.

Calculators eliminate many of the mistakes that some students ordinarily make without them. Mainly,

here, I am talking about mistakes in arithmetic. Students make fewer mistakes because they do not have to remember so many basic arithmetic facts.

One of the problems with using hand-held caculators is that there are so many different types of them. One student might have a hand-held calculator with only the four basic functions (addition, subtraction, multiplication, and division), whereas another student, in the same class, may have one that is much more advanced. These two students will not have equality as far as their capability on various tests and other types of evaluations is concerned. So this is one of the problems or disadvantages of using hand-held calculators. If the professor could control the type of calculator each student has, this problem would be eliminated. Of course, this may necessitate the institution, or the department, purchasing a set of calculators for students to use. This would necessitate the development of a security process to assure that each student that is loaned a calculator returns it.

An alternative to this mode of operation would be for the institution or department to require the students to purchase their own calculators from the bookstore just as they purchase textbooks. The

students could be required to purchase a certain type of calculator. The professor could monitor the students in the classroom to make sure that they are using the required calculator and not some other type. During tests all students will be using the same type of calculator. This would put all students on an equal footing at test time. Unless there is some way of assuring that students have equality when taking tests, the test scores will not really be comparable.

To illustrate how calculators are used in college and university classrooms, suppose that we have the following set of data:

$$8,\ 9,\ 11,\ 34,\ 6,\ 3 \qquad (1)$$

Suppose, further, that we want to find the average for the six numbers in this data set. The statistical formula that we would have to use for this is

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} \qquad (2)$$

where n=number of scores, x_i = the scores, and $\sum$ = the summation symbol (sigma). The calculator program for

this problem would be as follows:

8 + 9 + 11 + 34 + 6 + 3 = / 6 = (3)

assuming that we are using a basic four function calculator. ("/" is the "divided by" button.) As indicated by the program, we would enter each number in the data set and then press the "plus" button until we have entered the last number. After entering the last number in the data set, we would press the "equals" button, then the "divided by" button, then 6, and then the "equals" button again. The final number on the visual display will be the mean or average for the six numbers, which is approximately equal to 12 in this case.

A similar calculator program could be used to find the average velocity of particles in a physics class. It can be used to find the average IQ of students in a class in educational test and measurements. It can also be used to find the average yield of a set of portfolios in a financial mangement class. There are many other uses of this type of process in the various fields of study in our colleges and universities.

Let me mention one other use of the hand-held calculator in college and university classrooms. We

can use a hand-held calculator to find the variance of a data set. The formula for this is

$$s^2 = \frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n - 1} \qquad (4)$$

When using a four-function calculator with an x^2 button, it is best to do this type of problem using a table. Figure 1 shows how we can use a table to find the variance of the data set given above. The calculator program used to find the value of the entry at the end of each row is shown in the middle of the row. Notice that, to get the final answer to the problem, we have to sum the entries in the last column and then divide the sum by n-1 which is 5. As noted in the table, the variance of the above sample is 125.4. The standard deviation can very easily be found by simply entering the number we got for the variance into the calculator and then pressing the square root button.

I taught a graduate level statistics class wherein hand-held calculators were used. Students enjoyed using them and not having to do all of the arithmetic by hand.

FIGURE 1

Using a Basic Calculator to Find Variance

x_i	Calculator Program	$(x_i - \bar{x})^2$
8	8 - 12 = x^2	16
9	9 - 12 = x^2	9
11	11 - 12 = x^2	1
34	34 - 12 = x^2	484
6	6 - 12 = x^2	36
3	3 - 12 = x^2	81

Cal. Program: 16 + 9 + 1 + 484 + 36 + 81 = / 5

$$\sum_{i=1}^{n} (x_i - \bar{x})^2 = 627$$

$$s^2 = \frac{627}{5} = 125.4$$

USE OF COMPUTERS IN COLLEGE AND UNIVERSITY CLASSROOMS

The hand-held calculator is slowly being supplanted by the computer, i.e., the microcomputer, the minicomputer, and/or the mainframe computer. These instruments of computation are much less portable than the hand-held calculator, but they have greater capabilities. This is one of the advantages of the computers over the hand-held calculator, viz., the fact that they (the computers) have greater capabilities. They can also perform computations a lot quicker than a hand-held calculator can. In a hand-held calculator environment, we have to do part of complex calculations ourselves, using pencil and paper. In the case of the computer (micro-, mini-, or mainframe) everything is programmed into it. All we have to do is enter the numbers into it. It does everything else. It gives us the final answer to the problem. This is a great advantage of the computer.

The computer software packages discussed in this paper are not tools that one could use to teach students the meanings of various concepts. They are mainly used, in colleges and universities, to assist students in applying those concepts. This may be looked upon as one of the disadvantages of these types

of tools, viz.,they are not tools for teaching students concepts. We cannot use these tools to teach students what is meant by the "mean", or what is meant by the "standard deviation," or what is meant by the "variance." Students must first have instructions on these topics. It is only after that that they will be ready to use the tools discussed in this paper.

There are many different types of computers. We have microcomputers, minicomputers, and mainframe computers. And, now, in 1989, we even have what is referred to as supercomputers. My discussion of the use of computers in college and university classrooms mainly deals with mainframe computer systems. Some of the software packages that I mention can be used in a microcomputer or minicomputer environment also.

In the situations I am discussing, usually, the professor first explains to the students how to use the mainframe computer system in the classroom before actually taking them to the computer center so that they can get some hands-on experience. During the discussion, the professor explains to the students how to logon to the system. After that, the professor tells the students how to access the necessary computer program. If it is MINITAB, the professor tells the

students that after they get into the system, they must type the word "MINITAB." This will get them into the MINITAB system. If the software package that they are going to use is LINDO, after they logon, they simply type in the word "LINDO," then press the return button. This is how it is done at my institution.

When you are working with the SPSS (statistical package for the social sciences) or the SPSSX (statistical package for the social sciences-x), after you logon to the system, you have to access a word proccessing program. In these two software systems, you have to actually write a program of what you want to do. After that, you have to submit the program to the system (SPSS or SPSSX) for processing.

In most of the courses I've taught wherein students were allowed to use calculators for homework and classwork, they were also allowed to use them on tests. This has not been the case in situations wherein computers were involved. Usually, in these cases, students were allowed to use the computer during classwork and homework, but not on tests. The computer systems at many colleges and universities are not developed to the point that students can have access to a computer during tests.

LINDO

Now, let's talk in more detail about some of the computer software packages being used in colleges and universities. First, let's talk about the LINDO (Linear, Interactive, Discrete, Optimizer) software package. It can be used to solve linear programming problems, both maximum and minimum. Of course, the professor, before he or she introduces this software package, must teach the students how to solve linear programming problems by the graphing method. This should be the first step in the process, building up to the use of the computer in solving linear programming problems.

After the graphing method has been taught, the students should be introduced to the simplex tableau method. They should be told how the simplex tableau method works and what the objectives are in using the simplex tableau method. The students should be shown what pivoting means, how to determine the pivot column, how to determine the pivot row, how to determine the pivot element, and how to pivot. First, they should learn how to do these processes using paper and pencil. To illustrate this, let's solve the following sample

problem:

SAMPLE PROBLEM 2

A large TV manufacturer has warehouse facilities for storing its 25" color TVs in Chicago, New York, and Denver. Each month the city of Atlanta is shipped at most 400 twenty-five inch TVs. The cost of transporting each TV to Atlanta from Chicago, New York, and Denver averages $20, $20, and $40, respectively, while the cost of labor required for packing averages $6, $8, and $4, respectively. Suppose $10,000 is allocated each month for transportation costs and $3000 is allocated for labor costs. If the profit on each TV made in Chicago is $50, in New York is $80, and Denver is $40, how should monthly shipping arrangements be scheduled to maximize profit. (Mizrahi and Sullivan, 1988, p. 174)

If we let X1 = the number of TVs shipped from Chicago, X2 = the number of TVs shipped from New York, and X3 = the number of TVs shipped from Denver, we would get the following maximum linear programming problem:

Object Function: $50X1 + 80X2 + 40X3 = P$

Constraints: $X1 + X2 + X3 \leq 400$ (4)

$20X1 + 20X2 + 40X3 \leq 10000$

$6X1 + 8X2 + 4X3 \leq 3000$

where P = the profit. Next, in order to solve this linear programming problem using the simplex tableau method we introduce slack variables and transform the

objective function as follows:

$$
\begin{aligned}
X1 + X2 + X3 + s1 &= 400 \\
20X1 + 20X2 + 40X3 + s2 &= 10000 \\
6X1 + 8X2 + 4X3 + s3 &= 3000 \\
-50X1 + -80X2 - 40X3 + P &= 0
\end{aligned}
\qquad (5)
$$

The slack variables s1, s2, and s3 are added to the inequalities of (4) to make last two equations of (5). From (5) we get the following initial simplex tableau:

X1	X2	X3	s1	s2	s3	P	
1	1	1	1	0	0	0	400
20	20	40	0	1	0	0	10000
6	8	4	0	0	1	0	3000
-50	-80	-40	0	0	0	1	0

(6)

The first pivot element is 8. Pivoting around this element using pencil and paper we get

X1	X2	X3	s1	s2	s3	P	
1/4	0	1/2	1	0	-1/8	0	25
5	0	30	0	1	-5/2	0	2500
3/4	1	1/2	0	0	1/8	0	375
10	0	0	0	0	10	1	30000

(7)

Since there are no more negatives in the last row, the pivoting process is complete. We can simply read the solution from the final simplex tableau. It is

$$\begin{aligned} X1 &= 0 \\ X2 &= 375 \\ X3 &= 0 \\ P &= \$30000 \end{aligned} \qquad (8)$$

We can also use the simplex tableau method to solve minimum linear programming problems. We won't do one of those in this paper, but, if it is part of the professor's syllabus, he or she will want to cover it either before or after showing students how to solve maximum linear programming problems using the LINDO software package.

After teaching student how to solve maximum linear programming problems, and, of course, assigning students problems and giving them time to do them, the professor will want to introduce students to solving linear programming problems using LINDO. First, the professor will need to go over the login or logon procedure with the students. At my institution, the first thing that students do, after turning on the computer, is press the return key and wait for a few

seconds to see what happens. After that the students type the word "login" and press the return. The computer responds with "user id?" At this point the students will enter a special class code that I gave them and press the return button. The computer will respond with "Password?" At this point each student enters a secret password, that he or she has been assigned by the computer center, and presses the return button. The student is now in the system. The computer responds with some basic information about the system, and with an "OK," line.

At this point, the student types in the word LINDO. This lets the computer know that he or she wants to use the LINDO software package. When the student presses the return button, the computer puts him into the LINDO system. Next, the student must tell the computer what kind of linear programming problem (maximum or minimum) he or she is going to do and what the objective function (the function that he or she wants to maximize) is. After doing this, the student presses the return. The computer responds with ">". The student enters the letters "ST", indicating to the computer that the objective function is to be maximized subject to (ST) the constraints that he or she is going

to list on the next several lines. When the student presses the return this time the computer responds with ">" again. The student enters each constraint (one constraint per line), and presses the return after entering each, until all constraints have been entered, as shown below.

```
: MAX 50 X1 + 80 X2 + 40 X3
> ST
> X1 + X2 + X3 < 400                          (9)
> 20 X1 + 20 X2 + 40 X3 < 10000
> 6 X1 + 8 X2 + 4 X3 < 3000
```

(The computer knows that < really means < or =.)
At this point, the computer responds with ">" again. The student enters "END", presses the return key, and then enters the word "TABLO". The computer will respond by displaying the initial simplex tableau on the screen as shown in Figure 2.

The professor will have to explain to the students the similarities and differences between the initial simplex tableau we got when solving the maximum linear programming problem by hand and the one generated by the LINDO system. Figure 2 shows the initial simplex tableau generated by the LINDO system for SAMPLE

FIGURE 2
Initial Simplex Tableau (LINDO)

THE TABLEAU

ROW	(BASIS)	X1	X2	X3	SLK 2	SLK 3	SLK 4	
1	ART	-50.000	-80.000	-40.000	0.000	0.000	0.000	0.000
2	SLK 2	1.000	1.000	1.000	1.000	0.000	0.000	400.000
3	SLK 3	20.000	20.000	40.000	0.000	1.000	0.000	10000.000
4	SLK 4	6.000	8.000	4.000	0.000	0.000	1.000	3000.000
	ART	-50.000	-80.000	-40.000	0.000			

PROBLEM 2. If we compare this with the initial simplex tableau we got when we did the same problem by hand, we see that, in the LINDO system, we don't have a P-th column. Also, we see that the objective function row is called ART and is duplicated at the top of the tableau. Another difference is the way the slack variables are labeled. s1, s2, and s3 in the initial simplex tableau done using pencil and paper corresponds to SLK2, SLK3, and SLK4, respectively, in the LINDO generated simplex tableau. The student must realize these differences and must account for them when he or she interprets the output that he or she gets from the LINO system. The professor will have to inform the student that in subsequent tableaus the bottom row will be eliminated and the top row will remain. Thus, the professor should point out that a major difference between the subsequent by-hand tableaus and the computer generated ones will be the fact that the first row in the computer generated tableaus will be the last row in the by-hand tableaus. If this is pointed out in the beginning, I don't think that students will have any serious problem comparing the answers they get when doing the problems by hand with those they get when doing the problem using LINDO.

The amazing feature of LINDO is not that it can solve linear programming problems, but that it can solve them in steps. For example, once the student gets the initial simplex tableau, the computer will respond with ">". All the student has to do is enter the word "PIVOT" and press the return key. The computer will find the pivot element and pivot around it and then respond with ">". At this point, all the student has to do is type in the word "TABLO" and the computer shows the student how the simplex tableau looks after the first pivoting process is complete (Figure 3). The student should keep performing the PIVOT-TABLO sequence until the computer indicates that the pivoting process is complete and displays the final answers to the problem (Figure 4).

The LINDO system is presently being used in some graduate level classes in managerial accounting. I am presently using it in a class in contemporary mathematics. I have also seen it used in a graduate class in management of operations systems. All of the installations I have come in contact with have been on mainframe Prime computers.

FIGURE 3
Final Simplex Tableau (LINDO)

THE TABLEAU

ROW	(BASIS)	X1	X2	X3	SLK 2	SLK 3	SLK 4	
1	ART	10.000	0.000	0.000	0.000	0.000	10.000	30000.000
2	SLK 2	0.250	0.000	0.500	1.000	0.000	-0.125	25.000
3	SLK 3	5.000	0.000	30.000	0.000	1.000	-2.500	2500.000
4	SLK 4	0.750	1.000	0.500	0.000	0.000	0.125	375.000

FIGURE 4
Display of Final Answer

LP OPTIMUM FOUND AT STEP 1

OBJECTIVE FUNCTION VALUE

1) 30000.000

VARIABLE	VALUE	REDUCED COST
X1	0.000000	10.000000
X2	375.000000	0.000000
X3	0.000000	0.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
2)	25.000000	0.000000
3)	2500.000000	0.000000
4)	0.000000	10.000000

NO. ITERATIONS= 1

MINITAB

Another computational software package being used in many of our college and university classrooms is MINITAB. MINITAB is a statistical software package. It is very user friendly. It is one of the simplest statistical systems to operate that I have encountered. It can be used to find the mean of a data set and the standard deviation. It can be used to perform t-tests, to do correlation and regression analyses, and multiple regression analysis. It can also be used to perform a host of other statistical procedures.

To illustrate how it works, let's say that we want to determine the regression line for the data given below:

The values of exports and incomes of foreign investments are listed (in billions of dollars) for various years. (Triola, 1986, p. 430)

Exports	16	20	27	39	56	63	66
Incomes on Foreign Investments	2	3	4	7	11	11	13

First, we would have to access the MINITAB system. To access the MINITAB system, after loging in, the student types in the word "MINITAB" and presses the return key. This puts the student in the MINITAB

system. The computer responds with "MTB>". The student responds with

NAME C1 = 'EXPORT', C2 = 'INCOME'

and presses the return key. The computer responds with "MTB>". The student responds with

READ 'EXPORT' 'INCOME'

and presses the return key. The computer responds with "DATA>". The students responds by entering the first number in the first sample, skipping a space, then entering the first number in the second sample and pressing the return key. The computer responds with "DATA>". The students keeps entering data as shown in Figure 5 until all data have been entered. At that point, the computer will respond with "DATA>" again. This time the student responds with "END". The computer responds with "MTB>". To find the regression equation, the student responds with

REGRESS 'INCOME' ON 1 PREDICTOR 'EXPORT'

FIGURE 5

PARTIAL MINITAB PROGRAM
FOR REGRESSION ANALYSIS

```
MTB > READ C1 C2
DATA> 16 2
DATA> 20 3
DATA> 27 4
DATA> 39 7
DATA> 56 11
DATA> 63 11
DATA> 66 13
DATA>
```

and presses the return key. This tells the computer to write the regression equation for the two samples using EXPORT as the independent variable and INCOME as the dependent variable. When the student presses the return key, the computer will give the regression equation

INCOME = -1.37 + .211 EXPORT

along with other information not pertinent to this discussion. This regression equation can also be written in the form

Y = .211X - 1.37

which is more algebraic.

If this regression analysis had been done using pencil and paper, the following formulas would probably have been used by the student:

$$m = \frac{n\left(\sum_{i=1}^{n} x_i y_i\right) - \left(\sum_{i=1}^{n} x_i\right)\left(\sum_{i=1}^{n} y_i\right)}{n\left(\sum_{i=1}^{n} x_i^2\right) - \left(\sum_{i=1}^{n} x_i\right)^2}$$

$$b = \frac{\left(\sum_{i=1}^{n} y_i\right)\left(\sum_{i=1}^{n} x_i^2\right) - \left(\sum_{i=1}^{n} x_i\right)\left(\sum_{i=1}^{n} x_i y_i\right)}{n\left(\sum_{i=1}^{n} x_i^2\right) - \left(\sum_{i=1}^{n} x_i\right)^2}$$

$$y = mx + b$$

SPSS

SPSS is an acronym for Statistical Package for the Social Sciences. It is a statistical software package that can be used to analyze data. The SPSS software system that I have used was installed on a mainframe Prime computer. I used it in a graduate class in advanced educational statistics, a graduate class in basic educational statistics, and in a class in management of operations systems. I also used it to analyze the data I collected for my doctoral dissertation.

The SPSS system of computing usually requires the use of a word processing program. You have to write an SPSS "program" and submit it to the SPSS system. To use the SPSS system you must learn the job control language (JCL) of the system. The SPSS software system has a variety of capabilities. One of the advantages of the SPSS system is that in it we have a variety of statistical techniques that we don't have in MINITAB. With the SPSS system, we can do a factoral analysis, multiple regression analysis, discriminant analysis, etc. Disadvantages of SPSS include the following: (1) you must learn to use a word processor to use it and (2) you must learn the job control language that goes

along with the system.

In the SPSS system the data file and program (or JCL) can be put in the same file or separate files. If you are doing several different analyses of the same data set, you will probably want to make separate files. On the other hand, if you are just doing one analysis, you will probably want to have just one file that combines the program (or JCL) and the data.

Typically, to use the SPSS system, the student first logs on to the system. After that, he or she enters a word processing program. Some of the ones I've used with SPSS are EDITOR, ED, and EMACS. While in the word processing program, the student writes the SPSS program and saves it. Next the student will enter the data in a separate file.

To illustrate this, suppose we want to perform a discriminant analysis to determine whether or not any of the Likert type items on a questionnaire are significant in predicting whether a respondent answers "yes" or "no" to one of the yes-no questions on the questionnaire. The job control language program for this analysis is shown in Figure 6. The partial data file (separate) is shown in Figure 7. The pertinent output from the SPSS system is shown in Figure 8.

FIGURE 6

SPSS PROGRAM FOR A
MULTIPLE DISCRIMINANT ANALYSIS

```
RUN NAME          MULTIPLE DISCRIMINANT ANALYSIS
PAGESIZE          NOEJECT
INPUT MEDIUM      [AWEARL>DATA-DISSERTATION]
N OF CASES        147
VARIABLE LIST     CLLG INTvsML H.N.OV H.N.HARD H.N.REQ STORAGE
                  MTHDOBTN CUTOFF DATEBTWN ACCURACY UPTODATE ONTIME
                  USEDCSN UNDRSTND KNDINFO PRCSN NO.PP MTINFOND
                  KEEPTRCK ELMNT OWNBOOKS HNDvsCMP T.NT.BM PRINTER
                  MTHDOLVR NUMSIGN TMEGTSGN HOWGTSGN REDTAPE TRANSFER
                  CNTRLEXP FNL>APRL COMBINED CATABISs
VALUE LABELS      CLLG (1)COL Q (2)COL R (3)COL S (4)col t (5)COL U
                  (6)COL V (7)COL W (8)COL X (9)COL Y (10)COL Z/
                  INTvsML (1)INTERVIEW (2)MAIL/H.N.OV (1)NOT HAPPY
                  (2)HAPPY/H.N.HARD (1)NOT HAPPY (2)HAPPY/
                  H.N.REQ. (1)NOT HAPPY (2)HAPPY/STORAGE TO KEEPTRCK
                  MTHDOLVR TO CNTRLEXP (1)STRONGLY
                  DISAGREE (2)DISAGREE (3)NEUTRAL (4)AGREE
                  (5)STRONGLY AGREE/ELMNT TO
                  OWNBOOKS (1)NO (2)YES/HNDvsCMP (1)HAND (2)COMP
                  (3)BOTH/T.NT.BM (1)NO TERMINAL (2)TERMINAL/
                  PRINTER (1)NO (2)YES/FNL>APRL (1)NO (2)YES/
                  CATABISs (1)CATEGORY-I (2)CATEGORY-II

INPUT FORMAT      FIXED (34F1.0)
MISSING VALUES    COLLG TO COMBINED(0)
DISCRIMINANT      GROUPS = T.NT.BM (1,2)/
                  VARIABLES = H.N.OV STORAGE TO OWNBOOKS/
                  METHOD = WILKS/
                  PIN = .05/POUT = .06/TOLERANCE = .01 /PRIORS=SIZE
OPTIONS           1,5,6,7,11
STATISTICS        1,2,6,4
```

FIGURE 7

SPSS SAMPLE DATA FILE
(TRUNCATED)

```
1221232344434344243121102422432211
2112255452421244234121104244244211
3222114422442344224110102522124111
4211144422422424244121102244242111
5122244322443444224121104154154211
6221234154125344335110214333344212
7121244211152555124110104254243211
8112244322443444224121104154154211
.....
.....
.....
```

As indicated in Figure 6, each of the questionnaire items was given a name in the VARIABLE LIST. For example, questionnaire items 1, 2, and 3 were named CLLGE, INTvsML, and H.N.OV, respectively. The INPUT MEDIUM line, in Figure 6, specifies the name of the data files. The MISSING VALUES line and the VALUE LABELS line are optional. The DISCRIMINANT line indicates that we want to determine which Likert type items are significant in predicting whether a respondent answered "yes" or "no" to a yes-no questionnaire item called T.NT.BM. As can be seen from the pertinent SPSS output (Figure 8), only two questionnaire items (UNDSTND and UPTODATE) were significant in predicting whether a respondent answered "yes" or "no" to questionnaire item T.NT.BM. The unstandardized canonical discriminant function is

T.NT.BM=-0.5471338(UNDRSTND)+0.8441941(UPTODATE)-1.77070.

The standardized canonical discriminant function is

Z(for T.NT.BM)=-.59285(Z for UNDRSTND)
+.93770(Z for UPTODATE).

FIGURE 8

SAMPLE SPSS OUTPUT

```
           ACTION      VARS   WILKS'
STEP ENTERED REMOVED    IN     LAMBDA    SIG.    LABEL

  1  UNDRSTND           1    0.935888 0.0020
  2  UPTODATE           2    0.906437 0.0009

                CANONICAL DISCRIMINANT FUNCTIONS

                          PERCENT OF  CUMULATIVE    CANONICAL  :
FUNCTION  EIGENVALUE       VARIANCE     PERCENT    CORRELATION :---
                                                                :
     1*       0.10322      100.00       100.00       0.3058808  :   :
                                                                    v
-------------------------------------------------------------------
:
v   :   AFTER
 -->: FUNCTION  WILKS' LAMBDA  CHI-SQUARED   D.F.   SIGNIFICANCE

    :      0        0.9064369      14.047          2      0.0009
    :
* MARKS THE   1 CANONICAL DISCRIMINANT FUNCTION(S) TO BE USED IN
  REMAINING ANALYSIS.

STANDARDIZED CANONICAL DISCRIMINANT FUNCTION COEFFICIENTS
             FUNC  1

UPTODATE     -0.59285
UNDRSTND      0.93770


UNSTANDARDIZED CANONICAL DISCRIMINANT FUNCTION COEFFICIENTS
              FUNC  1

UPTODATE    -0.5471338
UNDRSTND     0.8441941
(CONSTANT)  -1.177070

        CANONICAL DISCRIMINANT FUNCTIONS EVALUATED AT GROUP
        MEANS (GROUP CENTROIDS)
   GROUP       FUNC   1

       1       -0.29792
       2        0.34173
```

SPSSX

SPSSX is an acronym for Statistical Package for the Social Sciences-x. It is a statistical software package that can be used to analyze data. The SPSSX software system that I have used was installed on a mainframe Prime computer. I used it to analyze the data I collected for a research projects I did. I plan to use it in my undergraduate statistics class.

The SPSSX system of computing usually requires the use of a word processing program. You have to write an SPSSX "program" and submit it to the SPSSX system. To use the SPSSX system you must learn the job control language (JCL) of the system. The SPSSX software system has a variety of capabilities. One of the advantages of the SPSSX system is that in it we have a variety of statistical techniques that we don't have in MINITAB. With the SPSSX system, we can do a factoral analysis, multiple regression analysis, discriminant analysis, etc. Disadvantages of SPSSX include the following: (1) you must learn to use a word processor to use it and (2) you must learn the job control language that goes along with the system.

In the SPSSX system the data file and program (or

JCL) can be put in the same file or separate files. If you are doing several different analyses of the same data set, you will probably want to make separate files. On the other hand, if you are just doing one analysis, you will probably want to have just one file that combines the program (or JCL) and the data.

Typically, to use the SPSSX system, the student first logs on to the system. After that, he or she enters a word processing program. Some of the ones I've used with SPSSX are ED, and EMACS. While in the word processing program, the student write the SPSSX program and saves it. Next the student will enter the data in a separate file.

To illustrate this, suppose we want to perform a multiple regression analysis to determine whether or not any of the items on a Likert-type questionnaire are significant in predicting one of the other Likert-type items on the questionnaire. The job control language program for this analysis is shown in Figure 9. The partial data file is also shown in Figure 9. The pertinent output from the SPSSX system is shown in Figure 10. In Figure 9, the DATA LIST line shows each questionnaire item (Q1, Q2,...) and the column in which it appears in the data set. For example, the responses

FIGURE 9

SPSSX SAMPLE PROGRAM FILE
WITH TRUNCATED DATA FILE

```
DATA LIST/ Q1 1 Q2 2 Q3 3 Q4 4 Q5 5 Q6 6 Q7 7 Q8 8 Q9 9 Q10 10 Q11 11 Q12 12
           Q13 13 Q14 14 Q15 15 Q16 16 Q17 17 Q18 18 Q19 19 Q20 20 Q21 21
           Q22 22 Q23 23 Q24 24 Q25 25 Q26 26 Q27 27 Q28 28 Q29 29 Q30 30
           Q31 31 Q32 32 Q33 33 Q34 34
MISSING VALUES   Q1 TO Q34 (0)
BEGIN DATA
122123234443434424312110242243221 1
211225545242124423412110424424421 1
322211442244234422411010252212411 1
421114442242242424412110224424211 1
512224432244344422412110415415421 1
622123415412534433511021433334421 2
712124421115255512411010425424321 1
811224432244344422412110415415421 1
.....
.....
.....
END DATA
REGRESSION     VARIABLES=Q6 TO Q9 Q11 TO Q20 Q25 TO Q31/
               DEPENDENT=Q31/
               METHOD=STEPWISE/
FINISH
```

FIGURE 10

SAMPLE SPSSX OUTPUT

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
Q18	-.277238	.083362	-.298356	-3.26	.0012
Q30	.331719	.075858	.317409	4.373	.0000
Q19	.204208	.089102	.206547	2.292	.0002
(Constant)	2.155884	.556314		3.875	.0002

to questionnaire item 1 is in column 1 of the data line. The responses to questionnaire item 2 are in column 2 of the data line. Zero is used for all MISSING VALUES. The REGRESSION subcommands show the questionnaire items (VARIABLES) that will be included in the analysis and the item (Q31) that will be used as the DEPENDENT variable. The output file (Figure 10) shows that only three of the questionnaire items were significant in predicting questionnaire item Q31, viz., Q18, Q30, and Q19. The unstandardized equation relating Q31 to Q18, Q30, and Q19 is

Q31=-.277238(Q18)+.331719(Q30)+.204208(Q19)
+ 2.155884

The standardized equation is

Z(for Q31)=-.298356(Z for Q18)+.317409(Z for Q30)
+.206547(Z for Q19)

SUMMARY

In summary, hand-held calculators and computers are being used more and more in college and university classes today. If the trend continues, more colleges and universities will have to either supply calculators for student use or require students to all buy the same type of calculator. One of the main advantages of the calculator over the mainframe computer, microcomputer, and minicomputer is its portability. A key disadvantage is its comparatively limited capability.

There are many computer software packages being used in college and university classrooms today. LINDO, MINITAB, SPSS, and SPSSX are only a few. LINDO is a good system to use in courses in contemporary mathematics, managerial accounting, and mangement of operation systems. MINITAB is a good package to use in quantitative analysis courses in MBA programs, in basic statistics courses, and other statistics related courses. SPSS and SPSSX are very similar statistical software packages. Their use should be encouraged in basic statistics courses, advanced statistics courses, MBA quantitative analysis courses, courses in research in education, courses in social science research, courses in psychological research, and other similar

quantitative courses. Implementation of these systems or similar systems in the above mentioned courses and similar courses, will help to equip our students with the tools they need to successfully face the unknown challenges that await them in the twenty-first century and beyond.

REFERENCES

Earl (Sr.), A. W. (1986). The budget information systems of selected colleges and universities in the state of virginia as described and perceived by budget managers. Unpublished doctoral dissertation, College of William and Mary, Williamsburg, Virginia.

Li, J. C. (1964). Statistical inference (Vol. 1). Ann Arbor: Edwards Brothers.

Minitab reference manual. (1986). State College, PA: Minitab, Inc.

Mizrahi, A., & Sullivan, M. (1988). Finite mathematics with applications for business and social sciences (5th ed.). New York: John Wiley & Sons.

Nie, N. H.; Hull, C. H.; Jenkins, J. G.; Steinbrenner, K.; & Bent, D. (1975). Statistical package for the social sciences. New York: McGraw-Hill.

Schrage, L. (1989). User's manual for linear, integer, and quadratic programming with LINDO (4th ed.). Redwood City, CA: Scientific Press.

SPSSX user's guide (2nd ed.). (1986). New York: McGraw-Hill, Chicago: SPSS, Inc.

Triola, M. F. (1986). Elementary statistics (3rd ed.). Menlo Park, CA: Benjamin/Cummings.